



# **A lethal combination**

**F-35 Joint Strike Fighter and M142 HIMARS sensor-to-shooter integration**

*By Col. Joe Russo*





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M142 HIMARS sensor-to-shooter  
integration has immediate, long-  
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range of military operations.*

The multi-role F-35 Joint Strike Fighter (JSF) represents a revolutionary advancement in air dominance capability with enhanced lethality and survivability in hostile, anti-access airspace environments. The aircraft combines fifth generation fighter aircraft characteristics — advanced stealth and integrated avionics with a comprehensive integrated sensor capability. The M142 High Mobility Artillery Rocket System (HIMARS), likewise brings a revolutionary surface-to-surface Fires capability to the 21st Century battlefield, delivering precision munitions at ranges and accuracy previously only delivered by aircraft. The

potential synergy of F-35/M142 HIMARS sensor-to-shooter integration has immediate, long-term applicability throughout the range of military operations to support:

- Naval expeditionary forces capable of supporting the establishment of sea control — denying sea lanes/access to adversaries, and conducting operational maneuver from the sea in anti-access/area denial (A2/AD) environments.
- Over the horizon targeting in support of ship-board HIMARS employment.
- Phased attrition of A2/AD defenses.
- Deep shaping and counter Fires targeting/engagement — distinctly beyond,

and complementary to current and emerging ground-based weapon systems and sensors.

Battery D, 2nd Battalion, 14th Marines conducted a command post exercise and Guided Multiple Launch Rocket System (GMLRS) live-fire annual training April 15-29 aboard Marine Corps Air Station Yuma, Ariz., and the Marine Corps Air Ground Combat Center in Twenty-nine Palms, Calif., to conduct a full mission profile C-130 borne, GMLRS live-fire exercise in support of Weapons Tactics Instructor (WTI) Course 17-2 Final Exercise 1 and Assault Support Tactics Course (AST) -2.



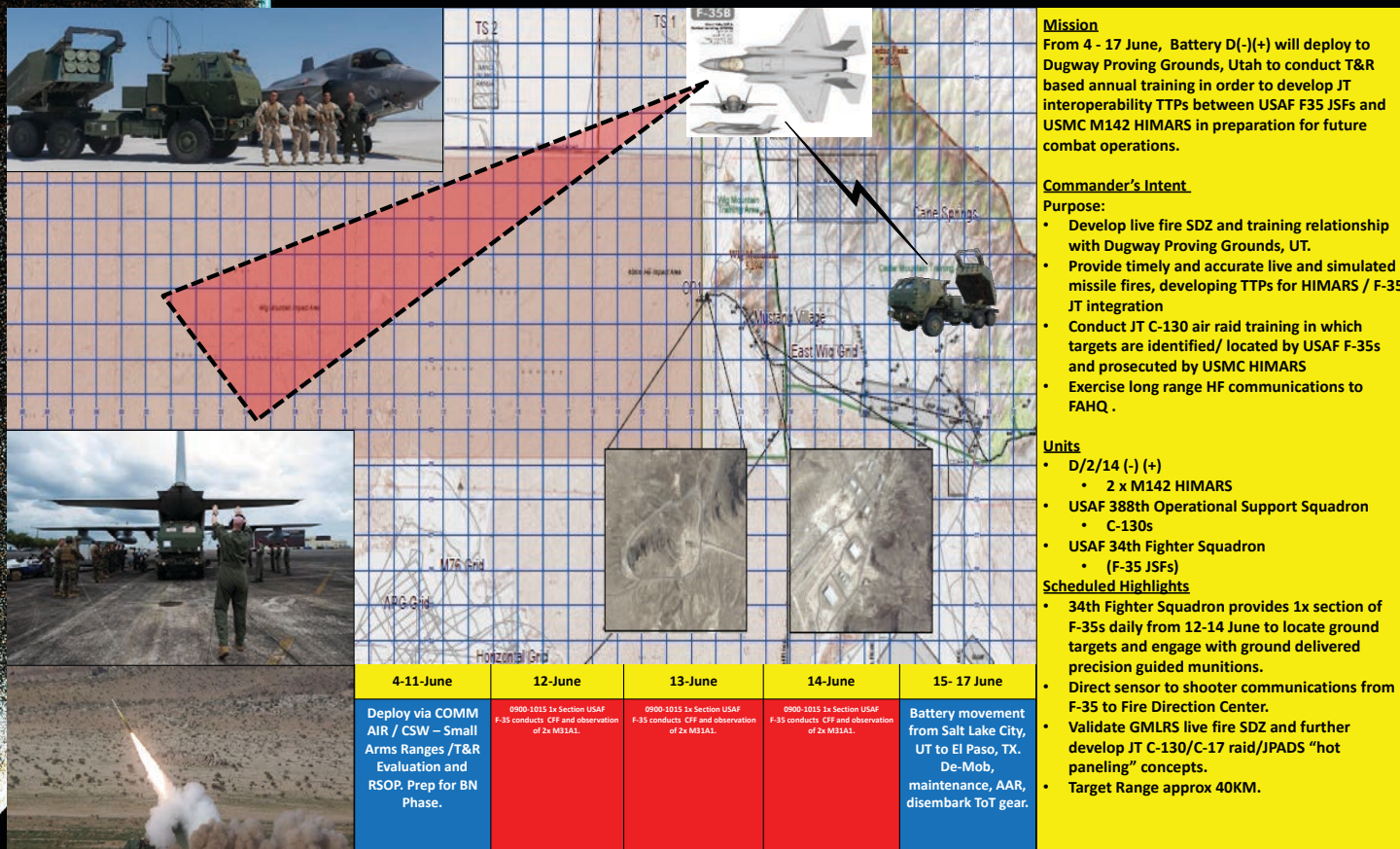


Figure 1. A mission slide from the F-35 Joint Strike Fighters and High Mobility Artillery Rocket Systems (HIMARS) integration exercise. HIMARS from D Battery, 2nd Battalion, 14th Marines, and F-35s from Marine Fighter Attack Squadron 211, 3rd Marine Aircraft Wing participated in the exercise. (Courtesy illustration)

Training highlighted the capabilities of the M142 HIMARS, and integration between the M142 HIMARS and F-35 JSF. D Battery fired four GMLRS Unitary rounds during the exercise. The GMLRS Unitary round is capable of precisely striking targets at ranges in excess of 84 kilometers with a blast-fragmentation warhead.

M142/F-35 JSF integration included HIMARS live fire in parallel with AST-2 in the Chocolate Mountain Training Range on April 19, engaging targets identified and relayed from F-35 JSFs from Marine Fighter Attack Squadron 211, 3rd Marine Aircraft Wing. This phase of training additionally marked the first ever GMLRS live-fire conducted in support of WTL.

14th Marine Regiment Force Artillery Headquarters liaison personnel integrated with the direct air support center (DASC) to enable a manual connection of the digital loop between F-35 sensors and the HIMARS platoon operations center/fire direction center. (Of note, a division-level fire support coordination center (FSCC) was

not available to participate in this training). This manual step reflects the key lesson learned regarding the necessity of integrating F-35 aircraft with Marine Air Ground Task Force command and control (C2) systems. While the F-35 maintains a robust digital messaging capability via Link 16 and Variable Message Format (VMF), it cannot transmit a digital call for fire (CFF) using the current version of the Advanced Field Artillery Tactical Data System (AFATDS). Our intent was to clearly identify this challenge, highlight the deficiency by means of a live-fire integration exercise, and then gather the input of subject matter experts from Lockheed Martin, Marine Aviation Weapons and Tactics Squadron -1, Marine Corps Tactical Systems Support Activity and Marine Corps Systems Command regarding requirements and future solutions.

The C-130 raid package (executed April 23-24) originated from Marine Corps Airstation Yuma, Ariz., and flew with M142 HIMARS launchers and the platoon operations center aboard C-130 aircraft from 3rd

Marine Aircraft Wing. After landing at the Marine Corps Air Ground Combat Center expeditionary airfield at Twenty-nine Palms, the HIMARS platoon established communications with the FSCC and prosecuted aviation (rotary-wing) acquired targets with two additional GMLRS in support of a battalion-sized air assault. This phase of training was executed in order to refine, and further demonstrate the utility and flexibility of M142 tethering to strategic lift aircraft. It also amplified the critical importance of this concept when considering the logistical sustainment of precision munitions.

Training objectives:

- Identify/highlight the digital disconnect between the F-35 JSF and AFATDS for future development.
- Conduct M142/F35 sensor-to-shooter training (command post exercise/live fire supported by VMFA 211 JSF aircraft).
- Further exercise HIMARS aircraft-airfield tethering tactics, techniques and procedures (TTPs).



- Conduct GMLRS live fire/Chocolate Mountains surface danger zone (SDZ) validation and further enable future training and integration with MAWTS-1.
- Further exercise long-range high-frequency (HF) communications employment (voice and digital).
- Further develop force artillery headquarters integration concept.
- Further develop HIMARS employment aboard C-130 aircraft/ Joint Precision Airdrop System (JPADS) employment (hot paneling). JPADS enables the M142 to maintain a GPS signal while in flight, thus decreasing the time required for a launcher to deliver missile Fires after debarking the aircraft.


#### F-35 data links/MAGTF C2 system gaps

The F-35 JSF employs advanced sensors capable of identifying, and precisely locating targets. HIMARS has the ability to deliver all-weather, day or night precision long-range missile Fires. The integration of the JSF's advanced intelligence surveillance and reconnaissance (ISR) targeting capabilities with the range and precision of HIMARS Fires offers a significantly enhanced ability to shape deep battlespace, while minimizing aircraft exposure and decreasing target decay that often occurs when mensuration of target coordinates is required.

The F-35 is capable of transmitting target coordinates via Link-16, VMF, or Multifunctional Advanced Data Link (MADL) messages. MADL is a low probability of

intercept and low probability of detection datalink that is optimized as a fighter-to-fighter data link. Link-16 and VMF offer avenues to digitally send formatted weapon employment quality target coordinates and other specifically formatted messages from the F-35 to MAGTF C2 systems. Notably, this cannot be done directly with current versions of AFATDS. Additionally, an executable digital CFF cannot be transmitted from the F-35 to the current version of AFATDS.

At WTI 17-2, participating F-35 crews identified two separate targets using their advanced, on-board sensors. The coordinates, which were passed to the DASC and subsequently to the HIMARS platoon fire direction center (FDC), required no further refinement. Both targets prosecuted by the



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HIMARS/F-35 sensor-to-shooter package directly impacted their respective targets at ranges of approximately 23 km from the launchers. While it must be noted that the sensor-to-shooter package was facilitated by a voice CFF, the aircraft's advanced sensor acquisition of precision targets, at night, and requiring no additional mensuration was truly the take away, and an indicator of the enhanced combat potential of the tethering of these systems. On a broader scope, the F-35's ability to identify and locate targets, and rapidly transmit targeting data to ground-based Fires systems, be they rocket, missile or cannon, has tremendous potential to complement ground-based target acquisition capabilities in support of both ground combat element (GCE) and MAGTF counter-Fires.

In addition to GMLRS, both Marine Corps and Army HIMARS units currently have the ability to employ Army Tactical

Missile System at ranges in excess of 162 miles. The ability of F-35s to penetrate enemy airspace-defenses, precisely identify targets, and relay those acquisitions to ground-based precision Fires systems at standoff ranges offers a revolutionary capability to the MAGTF/JFC deep-shaping effort.

#### **Current TTPs to address the digital gap**

The F-35 can pass limited digital traffic to Common Aviation Command and Control System (CAC2S) located in the DASC, but there is no digital CFF interoperability between CAC2S and AFATDS. Any information passed digitally to the CAC2S has to be manually entered into AFATDS to be sent to the battery or platoon FDC.

The F-35 can pass targets of opportunity using a voice CFF to the DASC or FSCC. This then must, likewise, be manually entered into an AFATDS and sent digitally to battery or platoon FDC.

Of note, while common for ground command and control agencies to have AFATDS operators, it is uncommon in the DASC and other senior air command and control agencies to have skilled AFATDS operators, knowledgeable in precision, surface-to-surface Fires employment.

In the interim, integration between the F-35, DASC, FSCC and HIMARS FDCs should be exercised to implement best TTPs. This will reduce kill-chain times and standardize employment of a liaison element to provide skilled AFATDS capability to air command and control agencies. Ultimately, the revolutionary combat effectiveness of this pairing can only be truly realized when the means to transmit a digital CFF from the aircraft to AFATDS can be established.

#### **Integrating with the 34th Fighter Squadron**

From June 4-17, Battery D(-) 2/14th again deployed to Dugway Proving Grounds,





#### EXERCISE OVERVIEW

- On 19 April, 1/D/2/14, VMFA 211 and members of the MAWTS-1 staff executed the first "sensor to shooter" GMLRS live fire integration of the M142 HIMARS and F-35 JSF in support of WTI 17.2.

- Training was conducted in order to further integrate HIMARS planning into the WTI curriculum, validate a newly developed GMLRS live fire SDZ in the Chocolate Mountains TA, enhance HIMARS/C-130 tethering concepts, and to further identify TTPs/digital communications requirements/shortfalls between the F-35 and MAGTF C2 systems.

#### HIGHLIGHTS

- 1 D 2/14 HIMARS platoon supported by 2 x VMFA 211 F-35 AC fired 2 x GMLRS in the Chocolate Mountains TA ISO AST-2.
- 2 x GMLRS direct hits on targets exclusively (no additional target mensuration required) acquired by F-35 sensor systems.
- FAHQ personnel integrated w/ DASC in order to reconnect the CFF/digital loop between the F-35 and the Platoon FDC.
- Chocolate Mountains GMLRS SDZ validated.
- C-130/M142 Tethering/JPADS "hot paneling" concepts of employment further validated.

#### UNITS

- 1st Platoon, Battery D 2/14 (EI Paso)
- VMFA 211
- MAWTS-1
- VMGR 352

Figure 2. The exercise overview from the F-35 Joint Strike Fighters and High Mobility Artillery Rocket Systems (HIMARS) integration exercise. HIMARS from D Battery, 2nd Battalion, 14th Marines, and F-35s from Marine Fighter Attack Squadron 211, 3rd Marine Aircraft Wing participated in the exercise. (Courtesy illustration)

Utah, to develop joint interoperability TTPs between Air Force F35 JSFS and Marine Corps M142 HIMARS.

The overarching intent of the exercise was to:

- Develop a live-fire GMLRS SDZ and training relationship with Dugway Proving Grounds.
- Provide timely and accurate GMLRS missile Fires, developing TTPs for HIMARS/F35 joint integration.
- Conduct joint C-130/HIMARS-raid training in which HIMARS and Multiple Launch Rocket System family of munitions are transported to a firing point by strategic lift aircraft and engage targets identified by USAF F-35s.
- Exercise long-range HF communications in order to refine C2 in a SATCOM denied-degraded operating environment.

The exercise highlighted the first joint live-fire integration between HIMARS and USAF F-35s. The 34th Fighter Squadron provided one section of F-35s daily from June 13-14 to locate ground targets using

onboard sensors to be prosecuted by HIMARS precision guided munitions. Direct sensor-to-shooter communications from F-35s were employed via ultra-high frequency voice communications from the aircraft to the battery FDC and then digitally transmitted from the FDC to launchers. Targets were engaged at ranges of approximately 42 kilometers with all GMLRS achieving effects on targets. All target locations were provided by USAF F-35s.

#### Way ahead

To develop the revolutionary capabilities of both the F-35 JSF and M142 HIMARS, several key actions must now occur. We must:

- Resolve the digital CFF divide between F-35 JSF and AFATDS.
  - Software?
  - Hardware/translator?
  - Commonality of digital communications?
- Identify ground combat element MAGTF ISR requirements of the F-35.
- Identify MAGTF staff requirements

(structure/processes/systems) for the management of what could conceivably become overwhelming volumes of information provided by the F-35.

- Develop joint interoperability TTPs/systems/processes between the Air Force, Marine Corps, Navy F-35's and MAGTF C2 systems.

The Marine Corps Operating Concept and Marine Corps Force 2025 each challenge the service to innovate to meet the needs of a dynamic, 21st Century battlefield. Status quo however, will not suffice, and the importance of developing innovative solutions to these significant service-level challenges is paramount.

<https://www.f35.com/about/capabilities>

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